Our Reference: 100200584-1 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellants:	David Champion et al.
Serial Number:	10/699,456
Filing Date:	October 31, 2003
Confirmation Number:	9588
Examiner/Group Art Unit:	Karie Amber O'Neill/1795
Title:	FUEL CELL WITH FILM HAVING NANOWIRES THEREIN

APPEAL BRIEF

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please enter the following Appeal Brief in the appeal filed February 18, 2010. Since April 18, 2010 was a Sunday, it is submitted that this response is being timely filed.

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I. REAL PARTY IN INTEREST

The real party in interest is Assignee, Hewlett-Packard Development Company, L.P., a limited partnership established under the laws of the State of Texas and having a principal place of business at 11445 Compaq Center Drive W., Houston, Texas 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

II. RELATED APPEALS AND INTERFERENCES

Appellants and the undersigned attorneys are not aware of any appeals or any interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-4, 6, 12-20, 48, 49, and 68-72 are the claims on appeal. *See,* Appendix.

Claims 1-4, 6, 12-20, 48, 49, and 68-72 are rejected.

Claims 21-47 and 50-67 are cancelled.

IV. STATUS OF AMENDMENTS

In response to the Final Office Action of November 18, 2009, no amendment pursuant to 37 C.F.R. § 1.116 was filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

In this summary of claimed subject matter, all citations are to the specification of United States Patent Application 10/699,456. Further, all citations are illustrative, and support for the cited element may be found elsewhere in the specification.

Independent claim 1:

A fuel cell (10) includes a substrate (12) and a patterned film (20) established on the substrate (12) (see Figs. 1 and 2, and page 6, line 15 through page 7, line 24). The patterned film (20) includes insoluble matter of an imaged photoresist (16) having a plurality of nanowires (14) dispersed therein (see Figs. 1 and 2, and page 7, lines 7-30). At least one of the plurality of nanowires (14) contacts at least an other of the plurality of nanowires (14) (see Figs. 1 and 2). The plurality of nanowires (14) enhances catalytic activity and conductivity of the patterned film (20) (see page 8, lines 11-25).

Independent claim 48:

A method of using a fuel cell (10) includes operatively connecting the fuel cell (10) to at least one of an electrical load (L) and an electrical storage device (S) (see Fig. 4, and page 10, line 6 through page 11, line 10). The fuel cell (10) includes a substrate (12) and a patterned film (20) established on the substrate (12) (see Figs. 1 and 2, and page 6, line 15 through page 7, line 24). The patterned film (20) includes insoluble matter of an imaged photoresist (16) having a plurality of nanowires (14) dispersed therein (see Figs. 1 and 2, and page 7, lines 7-30). At least one of the plurality of nanowires (14) contacts at least an other of the plurality of nanowires (14) (see Figs. 1 and 2). The plurality of nanowires (14) enhances catalytic activity and conductivity of the patterned film (20) (see page 8, lines 11-25).

Independent claim 49:

A fuel cell (10) includes a substrate (12) and a patterned film (20) established on the substrate (12) (see Figs. 1 and 2, and page 6, line 15 through page 7, line 24). The patterned film (20) includes insoluble matter of an imaged photoresist (16) (see page 7, lines 12-24). A plurality of means (14, 22, 24) are dispersed throughout the patterned film (20) for substantially enhancing catalytic activity and conductivity throughout the patterned film (20) (see Figs. 1-3, and page 8, line 26 through page 9, line 10). At least one of the plurality of means (14, 22, 24) contacts at least an other of the plurality of means (14, 22, 24) (see Fig. 3).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellants request review of the following grounds of rejection on appeal:

1) Whether claims 1-4, 6, 12, 15-20, 48, 49, and 68-71 are unpatentable under 35 U.S.C. § 103(a) as being obvious in view of U.S. Patent Appln. Pub. No. 2003/0027033 to Seabaugh et al. (referred to hereinafter as "Seabaugh") and U.S. Patent Appln. Pub. No. 2003/0180472 to Zhou et al. (referred to hereinafter as "Zhou").

2) Whether claims 1-3, 6, 12-20, 48, 49, and 68-72 are unpatentable under 35 U.S.C. § 103(a) as being obvious in view of U.S. Patent Appln. Pub. No. 2002/0098406 to Huang et al. (referred to hereinafter as "Huang") and Zhou.

VII. ARGUMENTS

The arguments presented hereinbelow address the rejections stated in the Final Office Action dated November 18, 2009. It is submitted, however, that the absence of a reply to a specific rejection, issue or comment in the Final Office Action does not signify agreement with or concession of that rejection, issue or comment. Finally, nothing in the following arguments of this appeal brief should be construed as an intent to concede any issue with regard to any claim, except as specifically stated below.

A) Whether claims 1-4, 6, 12, 15-20, 48, 49, and 68-71 are unpatentable under 35 U.S.C. § 103(a) as being obvious in view Seabaugh and Zhou.

a) Standard of Review

Obviousness is a question of law based on i) the scope and content of the prior art, ii) the differences between the prior art and the claims at issue, iii) the level of ordinary skill in the art, and iv) objective evidence of non-obviousness (*Graham v. John Deere Co.,* 383 U.S. 1, 17, 148 USPQ 459, 467 (1966)). An invention may be obvious if it merely combines "familiar elements according to known methods [to] yield predictable results" (*KSR Int. Co. v. Teleflex Inc, et al.*, 127 S. Ct. 1727; 167 L.Ed.2d 705; 2007 U.S. LEXIS 4745; 75 U.S.L.W. 4289; 82 USPQ2d 1385 (2007)).

A basic requirement to establish a case that a claim is *prima facie* obvious is that "***the prior art reference (or references when combined) must teach or suggest all the claim limitations***" (emphasis added; see MPEP § 2143). "In proceeding before the Patent and Trademark Office, the Examiner bears the burden of establishing a *prima facie* case of obviousness based upon the prior art" (*In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992)). "If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent" (*In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992)).

b) Claims 1-4, 6, 12, 15-20, 48, 49, and 68-71

For the reasons set forth herein, Appellants submit that the combination of Seabaugh and Zhou does not disclose all of the elements of the rejected claims, and thus the Examiner has failed to establish a *prima facie* case of obviousness.

In the Final Office Action dated November 18, 2009, the Examiner admits that Seabaugh fails to teach a patterned film including soluble matter of an imaged photoresist having a plurality of nanowires therein, but relies upon an intermediate device of Zhou for this deficiency. In particular, the Examiner points to Fig. 9A and paragraph [0065] of Zhou to conclude that the reference teaches that a patterned glass substrate is formed with periodic hydrophobic regions that are covered with photoresist and hydrophilic regions which are free of the photoresist. The Examiner further states that "the substrate is immersed into a SWNT/water suspension, which would allow for the nanowires to be dispersed in the already present photoresist material." (See page 11 of the Final Office Action.) The Examiner continues to say that, in Zhou, after imaging/developing occurs, SWNT form on the hydrophilic regions which are free of photoresist, but insoluble photoresist material and nanowires are still present on the hydrophobic regions; and then the substrate is washed to remove the insoluble photoresist. The Examiner concludes that before washing, the insoluble photoresist and the nanowires are present in an *intermediate form*. She quotes *Ex Parte Brinton* (82 USPQ 112), which states, "Where the products produced by the reference process are neither transitory nor ephemeral but are by nature tangible and permanent pending the subsequent treatment to which they are subjected. It is held that such products, though intermediate, in the reference, are anticipatory of the product defined by the claims on appeal." The Examiner includes that the intermediate product of Zhou (allegedly "a patterned film including insoluble matter of an imaged photoresist having a plurality of nanowires therein") supplies the deficiencies of Seabaugh, and thus the combination renders obvious the Appellants' invention as defined in the independent claims.

The Appellants respectfully submit that the Examiner is misconstruing the teachings of the Zhou reference, and that the intermediate product of Zhou does **NOT** supply the deficiencies of Seabaugh. As such, the combination of the references does not result in the Appellants' device or method as defined in the pending claims.

Neither Fig. 9A nor paragraphs [0065] and [0066] of Zhou teaches or suggests a plurality of nanowires in an imaged photoresist as suggested by the Examiner. Rather, as will be fully explained hereinbelow, both Fig. 9A and paragraphs [0065] and [0066] teach first hydrophobic regions (e.g., reference numeral 910) which are covered by the photoresist alone (i.e., is not mixed with nano-objects) and second hydrophilic regions (e.g., reference numeral 920) which are free of the photoresist and have single-wall nanotubes (SWNT) or nano-objects deposited thereon. Fig. 9A has been reproduced herein with some explanatory arrows and comments to facilitate understanding.

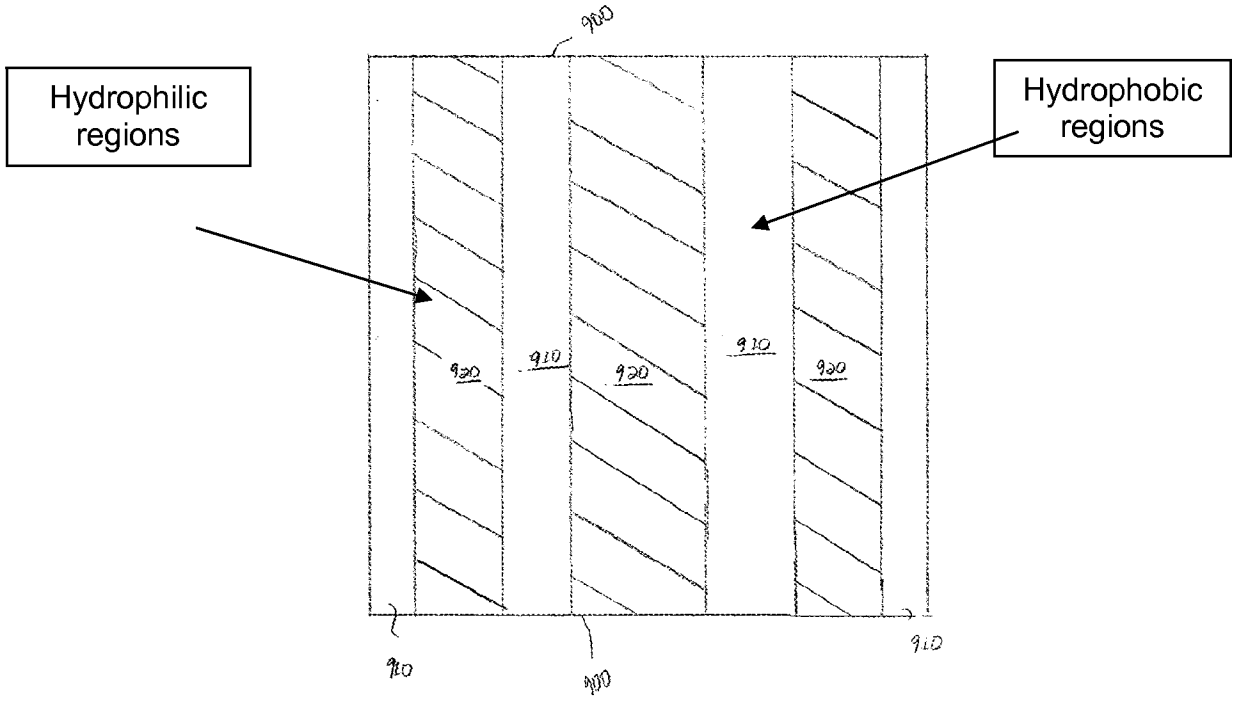

Figure 9A

Fig. 9A of Zhou

In paragraph [0065], Zhou states that a thin layer of photoresist is spin-coated onto a top surface of the glass slide, and that a photo mask with periodic lines and a UV light are used to pattern the photoresist. Chemicals are then used to remove the photoresist materials that are exposed to UV light. This process forms the structure shown in Fig. 9A, which includes periodic hydrophobic regions which are covered by the photoresist 910 and hydrophilic regions 920 which are free of the photoresist. Since the portions of the glass substrate are hydrophilic, it is clear from the description of Zhou that the presence of the photoresist renders the other portions hydrophobic.

One of ordinary skill in the art would recognize that hydrophobic regions are lacking an affinity for water, or tend to repel and not absorb water, or tend not to dissolve in or mix with or be wetted by water. In contrast, one of ordinary skill in the art would also recognize that hydrophilic regions have a strong affinity for water, or tend to dissolve in, mix with, or be wetted by water.

Zhou further teaches, in paragraph [0065], that the glass with patterned hydrophobic and hydrophilic regions is submersed into a single-wall nanotube/**water** suspension. Based on the common definitions of hydrophobic and hydrophilic, one skilled in the art would understand that even though the entire patterned glass substrate of Zhou is submersed in the aqueous suspension, the hydrophobic regions (i.e., the photoresist regions) would repel the water-based suspension and would not mix with the suspension or anything in the suspension (i.e., the nanotubes/nano-objects). As such, the water-based suspension (including the nanotubes/nano-objects therein) would be ***repelled by the hydrophobic region and would be drawn toward the hydrophilic regions*** not covered with photoresist.

As such, it is submitted that the Examiner's conclusion that "the substrate is immersed into a SWNT/water suspension, which would allow for the nanowires to be dispersed in the already present photoresist material" goes against basic chemical principles. Appellants note that, contrary to the Examiner's assertion that nanowires are present in the photoresist material, Zhou never mentions that the nanowires (i.e.,

nanotubes) mix with the photoresist. This lack of teaching is likely due to the fact that nanotubes in a water-based solution would **not** mix with a hydrophobic photoresist, contrary to the Examiner's suggestion that the nanotubes in a water-based solution would mix with the hydrophobic photoresist.

For all of these reasons, the Appellants disagree with the Examiner's conclusion about the intermediate form of Zhou's device. Since the photoresist regions of Zhou are hydrophobic, it is submitted that the intermediate device of Zhou would have the photoresist regions 910 (with no SWNT/water suspension present), and the hydrophilic regions 920 (with the SWNT/water suspension present). This follows the **actual** teachings of Zhou and also follows basic chemical principles of hydrophilicity and hydrophobicity. It is submitted that the actual intermediate device of Zhou is in sharp contrast to the Examiner's suggested intermediate device, because the actual intermediate device **does not** have nanotubes present in the photoresist.

In light of these arguments, the Appellants submit the following regarding the combination of Seabaugh and Zhou. Again, it is noted that the Examiner asserts that one skilled in the art would use the insoluble matter of the imaged photoresist of Zhou, which allegedly (but does not actually) has nano-objects therein, in the fuel cell of Seabaugh because Zhou teaches that imaged photoresist techniques can form an electrode.

Zhou does teach that the hydrophobic photoresist (without ever having nano-objects therein) is used to pattern an electrode (as a mask for depositing nano-objects on non-masked, hydrophilic areas), and that such resist is removed from the device. As explained above, neither the final device nor the intermediate device of Zhou includes the hydrophobic photoresist having the nano-objects therein (rather, they are present in a water-based suspension, and then next to the photoresist, and then alone on the substrate). When the photoresist and nano-objects are both present in the intermediate device, the nano-objects are present in the hydrophilic regions **NEXT TO** the hydrophobic photoresist regions. Since Zhou never teaches or even suggests that the photoresist has nano-objects therein, it is submitted that one skilled in the art would not

make the giant leap to i) include the nano-objects in the photoresist (which is not taught or suggested by either of the cited references) and ii) use the nano-object-containing photoresist in the final device. These teachings are simply not present in the cited references, and in fact, Zhou essentially *teaches away* from the conclusions drawn by the Examiner because i) the photoresist is hydrophobic, ii) the nano-objects are present in a hydrophilic suspension and would not mix with the photoresist, and iii) the photoresist is removed from the final device of Zhou.

As such, the Appellants submit that the Examiner's argument regarding using the photoresist of Zhou in the fuel cell of Seabaugh is not supported by the teachings of the references, taken singly or in combination. Seabaugh uses very specific materials, and Zhou does not teach or suggest that his photoresist mask is a suitable substitute for such materials. In fact, contrary to the Examiner's conclusions, Zhou teaches away from including the nano-objects in the photoresist and also teaches away from including the photoresist in the final device.

For all the reasons stated above, it is submitted that Applicants' invention as defined in independent claims 1, 48 and 49, and in those claims depending therefrom, is not anticipated, taught or rendered obvious by Seabaugh, either alone or in combination with Zhou, and patentably defines over the art of record.

B) Whether claims 1-3, 6, 12-20, 48, 49, and 68-72 are unpatentable under 35 U.S.C. § 103(a) as being obvious in view of Huang and Zhou.

In the Final Office Action dated November 18, 2009, the Examiner admits that Huang fails to teach a patterned film including soluble matter of an imaged photoresist having a plurality of nanowires therein, but relies upon an intermediate device of Zhou for this deficiency.

Appellants reiterate the arguments set forth hereinabove regarding Zhou, namely that the reference never teaches that the nano-objects are present in the photoresist. As such, it is submitted that the intermediate product of Zhou does **NOT** supply the deficiencies of Huang. Since Zhou never teaches or even suggests that the photoresist

has nano-objects therein, it is again submitted that one skilled in the art would not make the giant leap to i) include the nano-objects in the photoresist (which is not taught or suggested by either of the cited references) and ii) use the nano-object containing photoresist in the final device. These teachings are simply not present in the cited references, and in fact, Zhou essentially *teaches away* from the conclusions drawn by the Examiner because i) the photoresist is hydrophobic, ii) the nano-objects are present in a hydrophilic suspension and would not mix with the photoresist, and iii) the photoresist is removed from the final device of Zhou.

As such, the Appellants submit that the Examiner's argument regarding using the photoresist of Zhou in the fuel cell of Huang is not supported by the teachings of the references. Huang also uses very specific materials, and Zhou does not teach or suggest that his photoresist mask is a suitable substitute for such materials. In fact, contrary to the Examiner's conclusions, Zhou teaches away from including the nano-objects in the photoresist and also teaches away from including the photoresist in the final device.

For all the reasons stated above, it is submitted that Applicants' invention as defined in independent claims 1, 48 and 49, and in those claims depending therefrom, is not anticipated, taught or rendered obvious by Huang, either alone or in combination with Zhou, and patentably defines over the art of record.

VIII. CONCLUSION

The Appellants respectfully submits that claims 1-4, 6, 12-20, 48, 49, and 68-72 as currently pending fully satisfy the requirements of 35 U.S.C. §§ 102, 103 and 112. Accordingly, Appellant(s) respectfully request that the Board of Patent Appeals and Interferences find for the Appellant(s) and reverse the rejection of each of Appellants' claims 1-4, 6, 12-20, 48, 49, and 68-72 under 35 U.S.C. § 103(a) as being unpatentable over Seabaugh and Zhou or under 35 U.S.C. § 103(a) as being unpatentable over Huang and Zhou. In view of the foregoing, favorable consideration and passage to issue of the present application is respectfully requested.

Respectfully submitted,

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JCD/JRK/hmp

IX. CLAIMS APPENDIX

1. (Previously presented) A fuel cell, comprising:

a substrate; and

a patterned film established on the substrate, the patterned film including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, at least one of the plurality of nanowires contacting at least an other of the plurality of nanowires;

wherein the plurality of nanowires enhances catalytic activity and conductivity of the patterned film.

2. (Original) The fuel cell as defined in claim 1 wherein the plurality of nanowires increases the number of sites per unit volume where catalysis takes place.

3. (Original) The fuel cell as defined in claim 1 wherein the substrate is an electrolyte.

4. (Original) The fuel cell as defined in claim 3 wherein the electrolyte is at least one of oxygen ion conducting membranes, proton conductors, carbonate (CO_3^{2-}) conductors, OH^- conductors, cubic fluorite structures, doped cubic fluorites, proton-exchange polymers, proton-exchange ceramics, yttria-stabilized zirconia, samarium doped-ceria, gadolinium doped-ceria, $La_aSr_bGa_cMg_dO_{3-\delta}$, and mixtures thereof.

6. (Original) The fuel cell as defined in claim 1 wherein the plurality of nanowires is formed from at least one of carbon, copper, nickel, platinum, gold, iron, alloys thereof, stainless steel, lanthanum strontium chromite, current collector materials,

electrode materials, catalyst materials, electrolyte filament materials, and mixtures thereof.

12. (Previously presented) The fuel cell as defined in claim 1 wherein the patterned film comprises a cathode.

13. (Original) The fuel cell as defined in claim 12 wherein the plurality of nanowires comprises metallic components of cathode material.

14. (Original) The fuel cell as defined in claim 13 wherein the cathode metallic components comprise at least one of rhodium, platinum, silver, alloys thereof, and mixtures thereof.

15. (Previously presented) The fuel cell as defined in claim 1 wherein the plurality of nanowires is randomly oriented throughout the patterned film.

16. (Previously presented) The fuel cell as defined in claim 1 wherein each of the plurality of nanowires has a diameter ranging between about 1 nm and about 100 nm.

17. (Previously presented) The fuel cell as defined in claim 1 wherein each of the plurality of nanowires has a diameter ranging between about 10 nm and about 50 nm.

18. (Previously presented) The fuel cell as defined in claim 1 wherein each of the plurality of nanowires has a length ranging between about 15 nm and about 2000 nm.

19. (Previously presented) The fuel cell as defined in claim 1 wherein each of the plurality of nanowires has a length ranging between about 100 nm and about 500 nm.

20. (Original) An electronic device, comprising:

a load; and

the fuel cell of claim 1 connected to the load.

21 – 47. (Canceled)

48. (Previously presented) A method of using a fuel cell, comprising the step of:

operatively connecting the fuel cell to at least one of an electrical load and an electrical storage device, the fuel cell comprising:

a substrate; and

a patterned film established on the substrate, the patterned film including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, at least one of the plurality of nanowires contacting at least an other of the plurality of nanowires;

wherein the plurality of nanowires enhances catalytic activity and conductivity of the patterned film.

49. (Previously presented) A fuel cell, comprising:

a substrate;

a patterned film established on the substrate, the patterned film including insoluble matter of an imaged photoresist; and

a plurality of means, dispersed throughout the patterned film, for substantially enhancing catalytic activity and conductivity throughout the patterned film, at least one of the plurality of means contacting at least an other of the plurality of means.

50 - 67. (Canceled)

68. (Previously presented) The fuel cell as defined in claim 1 wherein the fuel cell is a single chamber fuel cell.

69. (Previously presented) The fuel cell as defined in claim 1 wherein the plurality of nanowires is connected to at least one of catalytic nano-particles or electrolyte grains.

70. (Previously presented) The fuel cell as defined in claim 1 wherein the plurality of nanowires is formed from electrolyte filament materials, and wherein the fuel cell further comprises cathode material nanoparticles dispersed on and connected to the electrolyte filament material nanowires.

71. (Previously presented) The fuel cell as defined in claim 1 wherein the fuel cell is a solid oxide fuel cell.

72. (Previously presented) The fuel cell as defined in claim 1 wherein the imaged photoresist is a negative photoresist or a positive photoresist.

X. EVIDENCE APPENDIX

None.

XI. RELATED PROCEEDINGS APPENDIX

None.